

Small skin incision and fistula elevation for hemodialysis using the femoral vein

Francisco Alcocer, MD, Saul Perez, MD, and Camilo Martinez, MD, *San Luis Potosí, Mexico*

Background: Wound morbidity commonly accompanies transposition of the femoral vein when used for hemodialysis access, mainly because of the length of the skin incision. A short incision may reduce wound complications but may compromise the arteriovenous (AV) function because of the shorter length of femoral vein available for puncture. This report presents our experience with a modification of the original technique, in which a smaller skin incision and fistula elevation were used.

Methods: The clinical course of 25 AV fistulas in the thigh using the femoral vein was retrospectively analyzed. The original technique to create femoral AV access was used in 12 patients and the modified technique in 13. The procedures were performed between 2005 and 2007, and patients were monitored until January 31, 2011.

Results: Three fistulas failed in each group. Five patients in the original group had wound complications. No wound complications occurred in the modified group. The fistula was first used at an average of 10.45 weeks and 6.14 weeks, respectively. Patency was similar in both groups.

Conclusions: It is possible to obtain a functional AV fistula in the thigh using the femoral vessels and limiting the extent of the incision. Long-term patency is reasonable, despite the use of a short femoral segment for puncture. (*J Vasc Surg* 2012;56:753-6.)

Once the possibilities for hemodialysis access in the arm have been exhausted, several approaches using the legs may be considered.^{1,2} Among these, the transposition of the superficial femoral vein, first described by Gradman et al,^{3,4} seems to be the most durable option. Although the morbidity of this procedure was remarkably high, mainly related to ischemic events, modification of the original technique and better patient selection have dramatically reduced the complication rates.

Wound-related problems have remained an undesirable but expected hazard in these patients. Two main factors contribute to this: (1) patient-related (age, obesity, diabetes, etc) and (2) technique-related, mainly due to the length of the skin incision. Whereas patient-related risk factors may not be modifiable, it is possible to shorten the length of the skin incision in an attempt to reduce wound morbidity. However, a small incision may result in a shorter femoral vein, which might jeopardize arteriovenous (AV) function. In this report, we present our experience with a modification of the original technique to create femoral AV access in which a smaller skin incision and fistula elevation were used.

METHODS

From January 2005 to January 2010, 265 AV accesses were performed in our hospital. Most included radiocephalic or brachiocephalic AV fistulas. From these patients, 25 (9.4%) underwent creation of thigh AV fistulas using the femoral vessels because upper extremity utilization failed. All patients had a history of multiple venous catheters, and 23 (92%) had presented with clinical evidence of central vein occlusion, with swollen arms or face, or both. Sixteen of these patients underwent a confirmatory upper extremity venogram, and eight then had angioplasty or stent placement to improve venous outflow.

The group with femoral access using the original technique was monitored from 0 to 72 months and the group that received the modified technique from 0 to 48 months. Sex distribution, age, and comorbidities were similar in both groups (Table I). Body mass index (BMI) was not documented preoperatively, but none of the patients were deemed to be obese during follow-up (BMI <30; mean, 25.15; range, 22-29.5 kg/m²). Preoperative vein mapping was not performed routinely in the beginning, but the last eight patients in the modified group underwent vein duplex imaging before surgery. There was no history of deep venous thrombosis, and all patients had palpable distal pulses preoperatively. However, two patients (excluded from this study) were denied surgery due to the absence of distal palpable pulses and underwent transhepatic venous catheter placement for hemodialysis.

The groups were divided as follows:

- A. *Original technique:* These comprised the first 12 patients and were performed from May 2005 to May 2007. The surgery followed the technique described by Gradman et al in 2001 and 2005.^{3,4} An incision from the inguinal crease to just above the knee was made to

From the Department of Vascular Surgery, Hospital Central, Colonia Universitaria.

Author conflict of interest: none.

Reprint requests: Francisco Alcocer, MD, Colonia Universitaria, Hospital Central, Department of Surgery, Avenida Venustiano Carranza 2395, 78290 San Luis Potosí, Mexico (e-mail: alcocerfrancisco@hotmail.com).

The editors and reviewers of this article have no relevant financial relationships to disclose per the JVS policy that requires reviewers to decline review of any manuscript for which they may have a conflict of interest.

0741-5214/\$36.00

Copyright © 2012 by the Society for Vascular Surgery.

doi:10.1016/j.jvs.2012.01.077

Table I. Patient characteristics

Variable ^a	Original (n = 12)	Modified (n = 13)	P
Age, years	60.5 ± 17.6	54.15 ± 15.9	.18
Females	7 (58.3)	9 (69.2)	.59
Diabetes	6 (50.0)	8 (61.5)	.60
Obese	0 (0.0)	0 (0.0)	.98
Palpable pulses	12 (100)	13 (100)	.98

^aContinuous data are presented as mean ± standard deviation and categorical data as number (%).

**Fig 1.** Photograph shows the surgical site with the original technique after a follow-up of 6 years.

harvest the femoral vein (Fig 1). The vein was dissected free from its junction to the profunda femoris vein proximally to beyond the adductor hiatus distally. The length of the harvested vein was not routinely measured but was at least 20 cm long. Tapering of the vein was used in one patient when there was discrepancy between the diameter of the femoral vein and the artery. No prosthetic material was used.

- B. Modified technique:** Includes the subsequent 13 patients (performed from May 2007 to February 2010), where a small skin incision and fistula elevation was used. Briefly, a 12-cm average incision (about the length of a number 3 scalpel handle) was placed in the middle aspect of an imaginary line between the anterior superior iliac spine and the medial femoral condyle. The sartorius muscle was retracted, and the superficial femoral vein was dissected free as distal as possible but without harvesting beyond the adductor hiatus. Proximally, the confluence of the profunda femoral vein was reached with the assistance of handheld retractors. The harvested vein was at least 15 cm long. An end-to-side anastomosis between the vein and the distal superficial femoral artery was performed, and the vein was placed in a superficial plane immediately below the incision, and three to four separate stitches were placed in the underlying fat. No subcutaneous suture was used, and the skin was closed with staples (Fig 2). Similarly, the vein was tapered in only one patient, and no prosthetic material was needed.

**Fig 2.** Modified technique at (A) surgery and (B) after 4 years of follow-up.**Table II.** Incidence of postoperative occurrences

Complication ^a	Original (n = 12)	Modified (n = 13)	P
Wound hematoma	1	1	>.99
Venous hypertension	2	0	.24
Leg ischemia	1	0	.14
Wound dehiscence	5	0	.001 ^b
Arteriovenous fistula failure	3	3	>.99
Death	5	3	.36
Maturation time (first time used), weeks	10.4 ± 5.6	6.1 ± 1.04	.01 ^b

^aContinuous data are presented as mean ± standard deviation and categorical data as number.

^bStatistically significant ($P < .05$).

A single surgeon performed all procedures. Two patients (one in each group) had unexpected duplicated femoral vein, and the two segments of vein were sewn for a longer vein segment. These two fistulas eventually failed and are considered in the final analysis of this report. Complications such as AV access thrombosis, wound infection, wound dehiscence, hematoma formation, leg ischemia, and leg edema were documented. Duplex ultrasound imaging was not used to determine maturation time; instead, the dialysis nurse team freely decided when they considered the fistula was ready to be used. Patients were monitored until January 31, 2011.

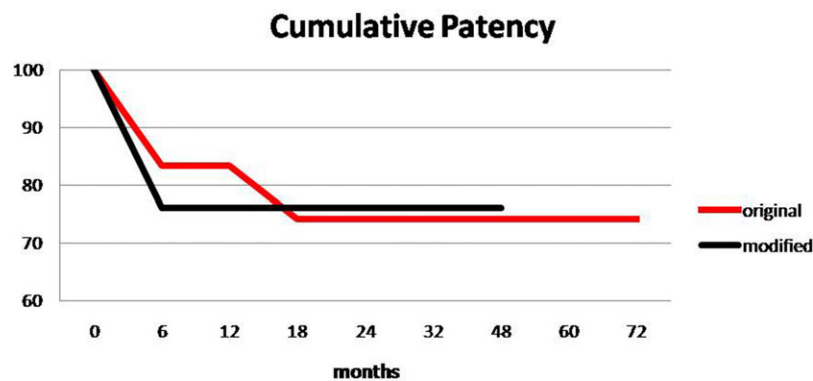


Fig 3. Kaplan-Meier estimates show graft patency in patients who underwent the original and modified techniques.

The clinical course of these 25 AV thigh fistulas was retrospectively analyzed. The χ^2 and mid-*P*-exact tests were used for categoric variables, and the two-sample independent *t*-test was used for continuous variables. Fistula patency was analyzed by Kaplan-Meier life-table analysis.

RESULTS

Table II depicts the results of the two groups. In the 12 patients in the traditional group, we identified one wound hematoma, two patients with venous hypertension (manifested with massive leg edema in both, plus venous claudication in one), one patient with lower extremity ischemia, and five patients with wound dehiscence at the distal aspect of the wound. Distal edema developed in the operated leg in most patients, regardless of the technique used, but this was mild and transient. Five patients died during follow-up, and three fistulas eventually failed.

In the 13 patients in the group with the modified technique, although the total follow-up was shorter by 24 months, there was no venous hypertension, leg ischemia, or wound dehiscence. One wound hematoma occurred. Three fistulas failed, and three patients died during follow-up.

No wound infection or cellulitis occurred in either group. The average time when the fistula was first used was 10.4 weeks for the original group (range, 6-24; median, 8 weeks) and 6.1 weeks for the modified group (range, 4-8; median, 6 weeks). The long-term access patency was similar in both groups (Fig 3).

DISCUSSION

The use of the femoral vein for patients who have exhausted access options in their arms provides a good-quality, long-standing access for long-term hemodialysis. When first described in 2001, the initial promising technique was hampered because of the high incidence of lower extremity ischemia. This inconvenience was subsequently resolved by improved technique (tapered femoral veins, distal femoral artery pressure measurements and fasciotomy) and improved patient selection (avoiding surgery in patients with significant distal oc-

clusive disease). Twenty years after its first report, we proposed another technical modification aimed to reduce wound morbidity. We were able to show that limiting vein harvesting works at least as good as the original description, with no complications at the puncture site despite the short vein segment.

However, reducing wound length clearly diminishes wound morbidity. Placing the vein below the suture line might carry more risk due to the possibility of wound dehiscence and graft exposure. Nevertheless, this technique is similar to the two-stage procedure of basilic vein transposition, where this complication does not seem to occur frequently,^{5,6} as has been shown in this report. Venous hypertension has also been reported when the vein harvesting includes the popliteal vein.⁷ None of our patients presented with this complication, which could be related to the sparing of the femoropopliteal segment; however, the small number of patients precludes us making a definite statement. The shorter interval between surgery and first vein puncture in the modified group was clearly related to the absence of wound complications, yet the nurse indicated it was “very easy to pinch” a vein that has a scar above as a “mark-line.”

We believe that this procedure should not be done in patients with arterial insufficiency or with history of previous ipsilateral deep venous thrombosis. Likewise, vein mapping should be used to avoid unexpected vein abnormalities, which happened in the early stages of this study. Although other authors have reported the use of the great saphenous vein for similar cases,¹ previous disappointing experiences with this vein in our group and our familiarity with the femoral vein in other surgical cases influenced us to use it primarily.⁸

CONCLUSIONS

It is possible to obtain a functional AV fistula in the thigh using the femoral vessels and limiting the extent of the incision, with concomitantly fewer wound complications. We acknowledge that a short vein would become a hazard in obese people, so it is likely that a longer vein may be required in these patients.

We thank Dr William D. Jordan, Jr, for the review of this manuscript.

AUTHOR CONTRIBUTIONS

Conception and design: FA, CM

Analysis and interpretation: FA

Data collection: SP, FA

Writing the article: FA

Critical revision of the article: FA, SP, CM

Final approval of the article: FA, SP, CM

Statistical analysis: FA

Obtained funding: Not applicable

Overall responsibility: FA

REFERENCES

1. Correa JA, de Abreu LC, Pires AC, Breda JR, Yamazaki YR, Fioretti AC, et al. Saphenofemoral arteriovenous fistula as hemodialysis access. *BMC Surg* 2010;10:28.
2. Gilbert JA, Gibbs PJ. Good long term patency rates associated with an alternative technique in vascular access surgery—the adductor loop arteriovenous graft. *Eur J Vasc Endovasc Surg* 2011;41:566-9.
3. Gradman WS, Cohen W, Haji-Aghaii M. Arteriovenous fistula construction in the thigh with transposed superficial femoral vein: our initial experience. *J Vasc Surg* 2001;33:968-75.
4. Gradman WS, Laub J, Cohen W. Femoral vein transposition for arteriovenous hemodialysis access: improved patient selection and intraoperative measures reduce postoperative ischemia. *J Vasc Surg* 2005;41:279-84.
5. Matsuura JH, Rosenthal D, Clark M, Shuler FW, Kirby L, Shotwell M, et al. Transposed basilic vein versus polytetrafluorethylene for brachial-axillary arteriovenous fistulas. *Am J Surg* 1998;176:219-21.
6. Hossny A. Brachio-basilic arteriovenous fistula: different surgical techniques and their effects on fistula patency and dialysis-related complications. *J Vasc Surg* 2003;37:821-6.
7. Modrall JG, Sadjadi J, Ali AT, Anthony T, Welborn MB 3rd, Valentine RJ, et al. Deep vein harvest: predicting need for fasciotomy. *J Vasc Surg* 2004;39:387-94.
8. Alcocer F, Zazueta E, Montes de Oca J. The superficial femoral vein: a valuable conduit for a short renal vein in kidney transplantation. *Transplant Proc* 2009;41:1963-5.

Submitted Nov 23, 2011; accepted Jan 30, 2012.